

**STORMWATER MANAGEMENT REPORT
“GRISTMILL VILLAGE”
DEFINITIVE PLAN
CONVENTIONAL DEVELOPMENT
GRAFTON, MASSACHUSETTS
March 13, 2015**

Prepared for:
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Project Number:
G-353
Grafton, Massachusetts

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DRAINAGE NARRATIVE

Design Methods and Objectives

The following drainage analysis has been prepared in accordance with the most current rules and regulations of the Town of Grafton, Massachusetts. Watershed areas were calculated for both the pre-development and post-development conditions. Existing and proposed ground cover conditions as well as terrain slopes were evaluated. Based upon the increased peak runoff from pre-development to the post development, storm water management systems were designed to attenuate the post development peak flows and runoff to be less than or equal to the pre-development rates of runoff. These calculations were performed using Hydrocad Stormwater Modeling Software for determining peak runoff and sizing detention/infiltration facilities for the 2, 10, 25 and 100 year storm event frequencies. Runoff hydrographs are calculated using the SCS Runoff equation and the SCS unitless hydrograph.

Existing Site Conditions

The existing site conditions were analyzed to determine tributary site runoff areas, flow patterns, open space including wooded areas, as well as existing soil types. The drainage area that was analyzed includes the most of the existing site to the north of Pleasant Street and Grist Mill Road to be developed. The existing study area includes wooded/vegetated areas and lawn. The total tributary drainage area is 14.88 acres. The site does not contain any existing impervious area other than a limited area of ledge. The existing slopes on site range from 2-30%. The site currently drains towards Pleasant Street and Grist Mill Road to the south.

Existing soils located on site were determined to be Merrimac fine sandy loam, Canton fine sandy loam, Paxton sandy loam and Chatfield-Hollis-Rock outcrop complex. Merrimac is classified as Hydrologic Group A and has a drainage class rating of "somewhat excessively drained". Canton is classified as Hydrologic Group B and has a drainage class rating of "well drained". Paxton is classified as Hydrologic Group C and has a drainage class rating of "well drained". Chatfield-Hollis-Rock outcrop complex is classified as Hydrologic Group D and has a drainage class rating of "well drained to somewhat excessively drained". Included in Appendix C are soil log forms detailing our finding from on site soil testing performed at this site. This soil testing was used to verify the hydrologic group of the soils at the site and determine seasonal high groundwater levels as the drainage design includes infiltration.

Proposed Site Conditions

In the post development condition, the property is proposed roadways, single family houses, driveways, lawn areas and stormwater management facilities associated with a 10 lot residential subdivision. The total impervious area in the post development condition is 1.48 acres. The total percentage of impervious area in the post development condition is 9.9%. The remaining portion of the site not developed is to remain wooded.

The proposed site drainage is separated into three subcatchment drainage areas. These subcatchments are physically separate in the post development condition through the use of an infiltration basin, a water quality inlet and subsurface recharge system. These methods are used in order to reduce peak runoff rates and treat runoff from developed paved areas in order to meet TSS removal requirements.

"Subcatchment P1" includes runoff from wooded areas to remain and some lawn area. This clean runoff is diverted with swales and culvert towards Grist Mill Road to the south

"Subcatchment P2" includes Greystone Drive, houses, driveway and lawn areas. This runoff is directed to an infiltration basin at the southwestern corner of the site. The combination of a deep sump catch basin, and infiltration basin provides over 80% TSS removal.

"Subcatchment P3" includes Millstone Drive and limited lawn area. This runoff is directed into a water quality inlet and subsurface recharge system near the intersection of Millstone Drive and Pleasant Drive. The combination of a deep sump

catch basin, water quality inlet and subsurface recharge system provides over 80% TSS removal including 44% pretreatment.

The proposed drainage design for this development meets or exceeds all requirements by the Town of Grafton and the Department of Environmental Protection. As the calculations demonstrate the proposed drainage design provides attenuation of peak rates and volumes of runoff, improves the quality of site runoff that flows offsite by achieving a minimum of 80% TSS removal for paved areas. The drainage design as proposed will improve the quality of runoff that currently exists on this site.

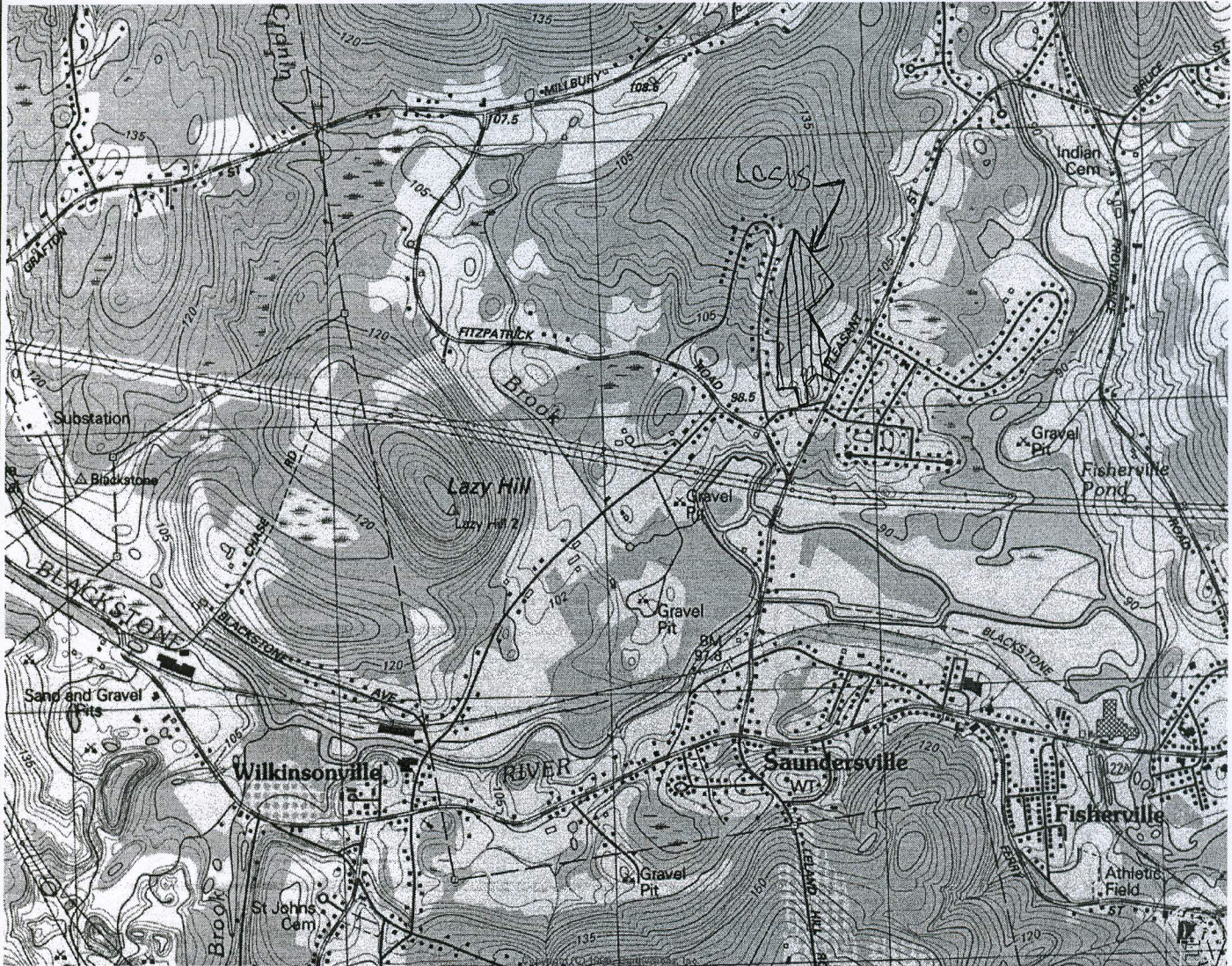
Drainage Analysis Summary

Pre-Development Drainage Reach (1R) - Existing Conditions Site Runoff to South

**Post-Development Drainage Reach (1R) - Combined post development runoff to South
Post Development Drainage Area (P1,P2, P3)**

Note: (Peak Flow Rate in cfs)

	<u>2 Year</u>	<u>10 Year</u>	<u>25 Year</u>	<u>100 Year</u>
Storm Intensity	3.0 inches	4.5 inches	5.3 inches	6.5 inches
Pre-Development (1R) To South	3.17	11.50	17.02	26.19
Post-Development (P1)	3.15	9.19	12.98	19.11
Post-Development (P2 Routed Through Basin 1)	0.00	0.00	0.00	0.00
Post-Development (P3 Routed Through Basin 2)	0.00	0.00	0.00	0.00
Post-Development (1R) To South	3.15	9.19	12.98	19.11
Reduction From Pre-Development to Post-Development	-0.02	-2.31	-4.04	-7.08

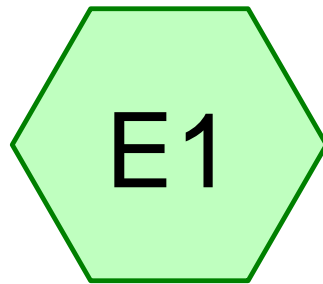


LOCUS PLAN

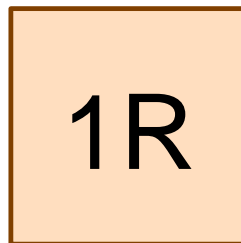
Source: USGS Quadrangles for
 Milford, MA
 7.5 x 15 minute series (metric)
 Scale: 1:25,000 or 1" = 2083.33'

4 Grist Mill Road & 102 Pleasant Street
 Grafton, Massachusetts

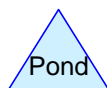
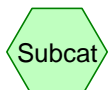
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Site Runoff



Pleasant St/Grist Mill Rd



Drainage Diagram for G-353-PRE

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.130	30	Woods, Good, HSG A (E1)
0.150	32	Woods/grass comb., Good, HSG A (E1)
4.380	55	Woods, Good, HSG B (E1)
1.970	58	Woods/grass comb., Good, HSG B (E1)
2.860	61	Lawn, Good, HSG B (E1)
1.480	70	Woods, Good, HSG C (E1)
3.850	77	Woods, Good, HSG D (E1)
0.060	98	Ledge (E1)
14.880		TOTAL AREA

G-353-PRE*Type III 24-hr 2-YR Rainfall=3.00"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Site RunoffRunoff Area=14.880 ac 0.40% Impervious Runoff Depth>0.37"
Flow Length=1,224' Tc=25.3 min CN=63 Runoff=3.17 cfs 0.464 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=3.17 cfs 0.464 af
Outflow=3.17 cfs 0.464 af**Total Runoff Area = 14.880 ac Runoff Volume = 0.464 af Average Runoff Depth = 0.37"**
99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac

G-353-PRE

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Type III 24-hr 2-YR Rainfall=3.00"

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Summary for Subcatchment E1: Site Runoff

Runoff = 3.17 cfs @ 12.48 hrs, Volume= 0.464 af, Depth > 0.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.850	77	Woods, Good, HSG D
4.380	55	Woods, Good, HSG B
0.130	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.970	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 2.860	61	Lawn, Good, HSG B
14.880	63	Weighted Average
14.820		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		Shallow Concentrated Flow, Segment 3
					Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		Shallow Concentrated Flow, Segment 4
					Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

Summary for Reach 1R: Pleasant St/Grist Mill Rd

Inflow Area = 14.880 ac, 0.40% Impervious, Inflow Depth > 0.37" for 2-YR event

Inflow = 3.17 cfs @ 12.48 hrs, Volume= 0.464 af

Outflow = 3.17 cfs @ 12.48 hrs, Volume= 0.464 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

G-353-PRE*Type III 24-hr 10-YR Rainfall=4.50"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Site RunoffRunoff Area=14.880 ac 0.40% Impervious Runoff Depth>1.08"
Flow Length=1,224' Tc=25.3 min CN=63 Runoff=11.50 cfs 1.335 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=11.50 cfs 1.335 af
Outflow=11.50 cfs 1.335 af**Total Runoff Area = 14.880 ac Runoff Volume = 1.335 af Average Runoff Depth = 1.08"**
99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac

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Type III 24-hr 10-YR Rainfall=4.50"

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Summary for Subcatchment E1: Site Runoff

Runoff = 11.50 cfs @ 12.40 hrs, Volume= 1.335 af, Depth > 1.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 10-YR Rainfall=4.50"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.850	77	Woods, Good, HSG D
4.380	55	Woods, Good, HSG B
0.130	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.970	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 2.860	61	Lawn, Good, HSG B
14.880	63	Weighted Average
14.820		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		Shallow Concentrated Flow, Segment 3
					Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		Shallow Concentrated Flow, Segment 4
					Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

Summary for Reach 1R: Pleasant St/Grist Mill Rd

Inflow Area = 14.880 ac, 0.40% Impervious, Inflow Depth > 1.08" for 10-YR event

Inflow = 11.50 cfs @ 12.40 hrs, Volume= 1.335 af

Outflow = 11.50 cfs @ 12.40 hrs, Volume= 1.335 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

G-353-PRE*Type III 24-hr 25-YR Rainfall=5.30"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Site RunoffRunoff Area=14.880 ac 0.40% Impervious Runoff Depth>1.54"
Flow Length=1,224' Tc=25.3 min CN=63 Runoff=17.02 cfs 1.907 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=17.02 cfs 1.907 af
Outflow=17.02 cfs 1.907 af**Total Runoff Area = 14.880 ac Runoff Volume = 1.907 af Average Runoff Depth = 1.54"**
99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac

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Type III 24-hr 25-YR Rainfall=5.30"

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Summary for Subcatchment E1: Site Runoff

Runoff = 17.02 cfs @ 12.38 hrs, Volume= 1.907 af, Depth > 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 25-YR Rainfall=5.30"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.850	77	Woods, Good, HSG D
4.380	55	Woods, Good, HSG B
0.130	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.970	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 2.860	61	Lawn, Good, HSG B
14.880	63	Weighted Average
14.820		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		Shallow Concentrated Flow, Segment 3
					Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		Shallow Concentrated Flow, Segment 4
					Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

Summary for Reach 1R: Pleasant St/Grist Mill Rd

Inflow Area = 14.880 ac, 0.40% Impervious, Inflow Depth > 1.54" for 25-YR event

Inflow = 17.02 cfs @ 12.38 hrs, Volume= 1.907 af

Outflow = 17.02 cfs @ 12.38 hrs, Volume= 1.907 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

G-353-PRE*Type III 24-hr 100-YR Rainfall=6.50"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: Site RunoffRunoff Area=14.880 ac 0.40% Impervious Runoff Depth>2.31"
Flow Length=1,224' Tc=25.3 min CN=63 Runoff=26.19 cfs 2.864 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=26.19 cfs 2.864 af
Outflow=26.19 cfs 2.864 af**Total Runoff Area = 14.880 ac Runoff Volume = 2.864 af Average Runoff Depth = 2.31"**
99.60% Pervious = 14.820 ac 0.40% Impervious = 0.060 ac

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Type III 24-hr 100-YR Rainfall=6.50"

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Summary for Subcatchment E1: Site Runoff

Runoff = 26.19 cfs @ 12.37 hrs, Volume= 2.864 af, Depth > 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-YR Rainfall=6.50"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.850	77	Woods, Good, HSG D
4.380	55	Woods, Good, HSG B
0.130	30	Woods, Good, HSG A
* 0.060	98	Ledge
1.970	58	Woods/grass comb., Good, HSG B
0.150	32	Woods/grass comb., Good, HSG A
* 2.860	61	Lawn, Good, HSG B
14.880	63	Weighted Average
14.820		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
5.1	566	0.1380	1.86		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
3.9	354	0.0280	1.51		Shallow Concentrated Flow, Segment 3
					Cultivated Straight Rows Kv= 9.0 fps
3.6	254	0.0280	1.17		Shallow Concentrated Flow, Segment 4
					Short Grass Pasture Kv= 7.0 fps
25.3	1,224	Total			

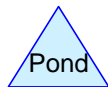
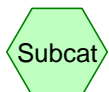
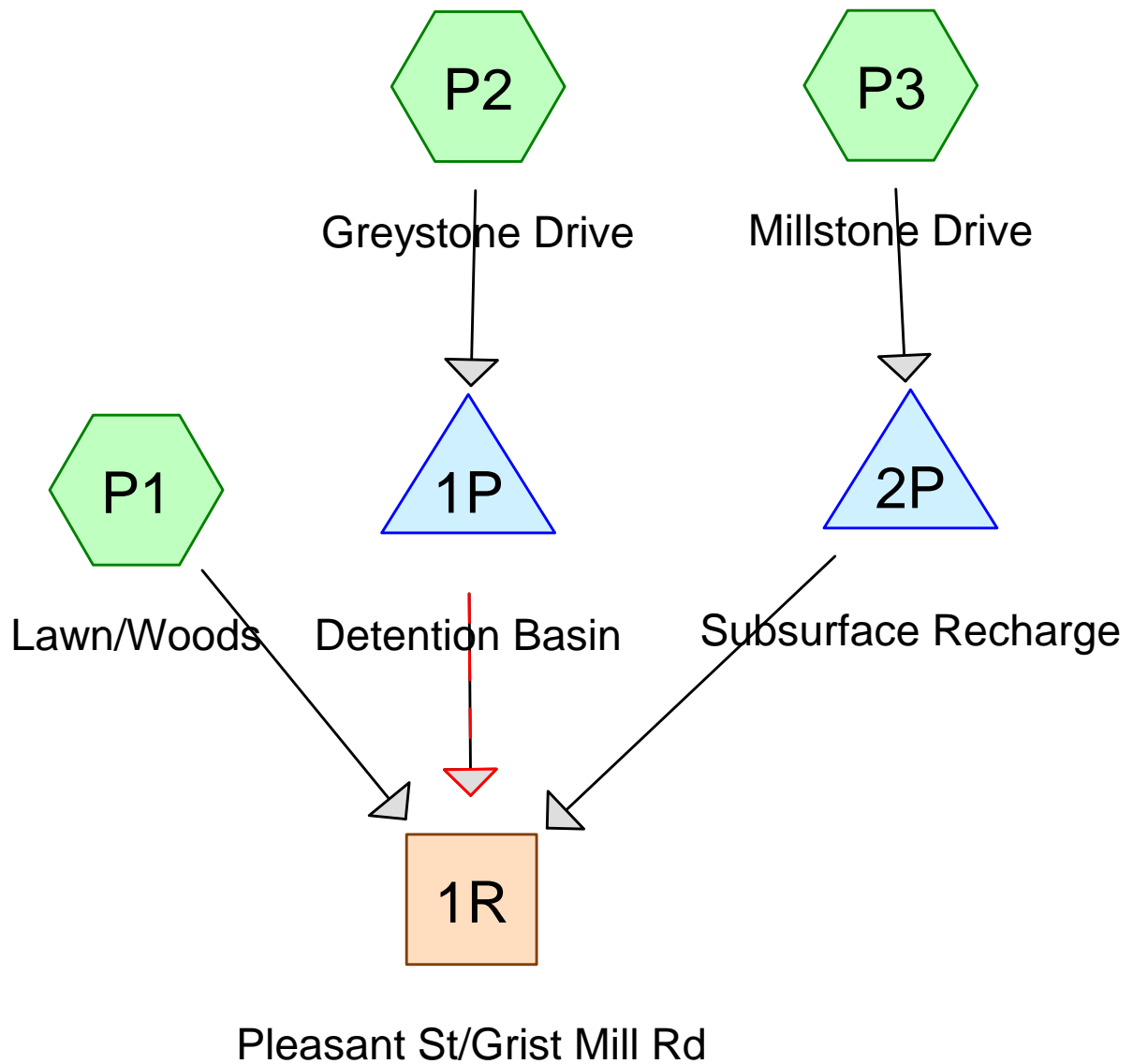
Summary for Reach 1R: Pleasant St/Grist Mill Rd

Inflow Area = 14.880 ac, 0.40% Impervious, Inflow Depth > 2.31" for 100-YR event

Inflow = 26.19 cfs @ 12.37 hrs, Volume= 2.864 af

Outflow = 26.19 cfs @ 12.37 hrs, Volume= 2.864 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.030	30	Woods, Good, HSG A (P1)
0.200	39	Lawn, Good, HSG A (P1,P3)
1.990	55	Woods, Good, HSG B (P1)
5.850	61	Lawn, Good, HSG B (P1,P2,P3)
1.480	70	Woods, Good, HSG C (P1)
3.680	77	Woods, Good, HSG D (P1)
0.170	80	Lawn, Good HSG D (P1)
1.420	98	Impervious (P2,P3)
0.060	98	Ledge (P1)
14.880		TOTAL AREA

G-353-POST*Type III 24-hr 2-YR Rainfall=3.00"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: Lawn/WoodsRunoff Area=10.610 ac 0.57% Impervious Runoff Depth>0.51"
Flow Length=1,640' Tc=33.9 min CN=67 Runoff=3.15 cfs 0.453 af**Subcatchment P2: Greystone Drive**Runoff Area=3.950 ac 31.65% Impervious Runoff Depth>0.78"
Flow Length=647' Tc=9.4 min CN=73 Runoff=3.20 cfs 0.256 af**Subcatchment P3: Millstone Drive**Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>0.98"
Flow Length=325' Tc=5.7 min CN=77 Runoff=0.38 cfs 0.026 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=3.15 cfs 0.453 af
Outflow=3.15 cfs 0.453 af**Pond 1P: Detention Basin**Peak Elev=328.24' Storage=3,292 cf Inflow=3.20 cfs 0.256 af
Discarded=0.77 cfs 0.253 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.77 cfs 0.253 af**Pond 2P: Subsurface Recharge**Peak Elev=328.24' Storage=222 cf Inflow=0.38 cfs 0.026 af
Discarded=0.13 cfs 0.026 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.026 af**Total Runoff Area = 14.880 ac Runoff Volume = 0.735 af Average Runoff Depth = 0.59"**
90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac

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Type III 24-hr 2-YR Rainfall=3.00"

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Summary for Subcatchment P1: Lawn/Woods

Runoff = 3.15 cfs @ 12.57 hrs, Volume= 0.453 af, Depth> 0.51"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.680	77	Woods, Good, HSG D
1.990	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 0.170	80	Lawn, Good HSG D
* 3.050	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
10.610	67	Weighted Average
10.550		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
4.1	476	0.1470	1.92		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		Shallow Concentrated Flow, Segment 3
					Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	Trap/Vee/Rect Channel Flow, Segment 4
					Bot.W=5.00' D=2.00' Z= 3.0 '/' Top.W=17.00' n= 0.033
0.1	61	0.0160	7.52	13.29	Circular Channel (pipe), Segment 5
					Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
15.6	464	0.0050	0.49		Shallow Concentrated Flow, Segment 6
					Short Grass Pasture Kv= 7.0 fps
33.9	1,640	Total			

Summary for Subcatchment P2: Greystone Drive

Runoff = 3.20 cfs @ 12.15 hrs, Volume= 0.256 af, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

Area (ac)	CN	Description
* 2.700	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.950	73	Weighted Average
2.700		Pervious Area
1.250		Impervious Area

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Type III 24-hr 2-YR Rainfall=3.00"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		Shallow Concentrated Flow, Segment 2 Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	Circular Channel (pipe), Segment 4 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

Summary for Subcatchment P3: Millstone Drive

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.026 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.00"

Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		Sheet Flow, Segment 2 Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	Circular Channel (pipe), Segment 3 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

Summary for Reach 1R: Pleasant St/Grist Mill RdInflow Area = 14.880 ac, 9.95% Impervious, Inflow Depth > 0.37" for 2-YR event
Inflow = 3.15 cfs @ 12.57 hrs, Volume= 0.453 af
Outflow = 3.15 cfs @ 12.57 hrs, Volume= 0.453 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 2-YR Rainfall=3.00"

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Summary for Pond 1P: Detention Basin

Inflow Area = 3.950 ac, 31.65% Impervious, Inflow Depth > 0.78" for 2-YR event
 Inflow = 3.20 cfs @ 12.15 hrs, Volume= 0.256 af
 Outflow = 0.77 cfs @ 12.65 hrs, Volume= 0.253 af, Atten= 76%, Lag= 30.2 min
 Discarded = 0.77 cfs @ 12.65 hrs, Volume= 0.253 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 328.24' @ 12.65 hrs Surf.Area= 13,864 sf Storage= 3,292 cf

Plug-Flow detention time= 39.2 min calculated for 0.252 af (99% of inflow)
 Center-of-Mass det. time= 35.1 min (861.6 - 826.6)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	142,666 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	13,371	0	0
330.00	17,446	30,817	30,817
332.00	21,564	39,010	69,827
334.00	25,437	47,001	116,828
335.00	26,238	25,838	142,666

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	331.50'	24.0" Vert. Orifice/Grate C= 0.600
#3	Secondary	334.50'	15.0' long x 15.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.77 cfs @ 12.65 hrs HW=328.24' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.77 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑ **2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Subsurface Recharge

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 0.98" for 2-YR event
 Inflow = 0.38 cfs @ 12.10 hrs, Volume= 0.026 af
 Outflow = 0.13 cfs @ 12.00 hrs, Volume= 0.026 af, Atten= 66%, Lag= 0.0 min
 Discarded = 0.13 cfs @ 12.00 hrs, Volume= 0.026 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 2-YR Rainfall=3.00"

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Peak Elev= 328.24' @ 12.44 hrs Surf.Area= 2,310 sf Storage= 222 cf

Plug-Flow detention time= 12.3 min calculated for 0.026 af (100% of inflow)

Center-of-Mass det. time= 11.4 min (825.0 - 813.6)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	4,158 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,395 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	2,310	0	0
332.50	2,310	10,395	10,395

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	332.50'	30.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.13 cfs @ 12.00 hrs HW=328.05' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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Type III 24-hr 10-YR Rainfall=4.50"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: Lawn/WoodsRunoff Area=10.610 ac 0.57% Impervious Runoff Depth>1.32"
Flow Length=1,640' Tc=33.9 min CN=67 Runoff=9.19 cfs 1.166 af**Subcatchment P2: Greystone Drive**Runoff Area=3.950 ac 31.65% Impervious Runoff Depth>1.75"
Flow Length=647' Tc=9.4 min CN=73 Runoff=7.58 cfs 0.575 af**Subcatchment P3: Millstone Drive**Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>2.05"
Flow Length=325' Tc=5.7 min CN=77 Runoff=0.82 cfs 0.055 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=9.19 cfs 1.166 af
Outflow=9.19 cfs 1.166 af**Pond 1P: Detention Basin**Peak Elev=328.76' Storage=10,803 cf Inflow=7.58 cfs 0.575 af
Discarded=0.83 cfs 0.563 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.83 cfs 0.563 af**Pond 2P: Subsurface Recharge**Peak Elev=328.85' Storage=784 cf Inflow=0.82 cfs 0.055 af
Discarded=0.13 cfs 0.055 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.055 af**Total Runoff Area = 14.880 ac Runoff Volume = 1.795 af Average Runoff Depth = 1.45"**
90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac

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Type III 24-hr 10-YR Rainfall=4.50"

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Summary for Subcatchment P1: Lawn/Woods

Runoff = 9.19 cfs @ 12.51 hrs, Volume= 1.166 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.680	77	Woods, Good, HSG D
1.990	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 0.170	80	Lawn, Good HSG D
* 3.050	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
10.610	67	Weighted Average
10.550		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
4.1	476	0.1470	1.92		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		Shallow Concentrated Flow, Segment 3
					Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	Trap/Vee/Rect Channel Flow, Segment 4
					Bot.W=5.00' D=2.00' Z= 3.0 '/' Top.W=17.00' n= 0.033
0.1	61	0.0160	7.52	13.29	Circular Channel (pipe), Segment 5
					Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
15.6	464	0.0050	0.49		Shallow Concentrated Flow, Segment 6
					Short Grass Pasture Kv= 7.0 fps
33.9	1,640	Total			

Summary for Subcatchment P2: Greystone Drive

Runoff = 7.58 cfs @ 12.14 hrs, Volume= 0.575 af, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (ac)	CN	Description
* 2.700	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.950	73	Weighted Average
2.700		Pervious Area
1.250		Impervious Area

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Type III 24-hr 10-YR Rainfall=4.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		Shallow Concentrated Flow, Segment 2 Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	Circular Channel (pipe), Segment 4 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

Summary for Subcatchment P3: Millstone Drive

Runoff = 0.82 cfs @ 12.09 hrs, Volume= 0.055 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=4.50"

Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		Sheet Flow, Segment 2 Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	Circular Channel (pipe), Segment 3 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

Summary for Reach 1R: Pleasant St/Grist Mill RdInflow Area = 14.880 ac, 9.95% Impervious, Inflow Depth > 0.94" for 10-YR event
Inflow = 9.19 cfs @ 12.51 hrs, Volume= 1.166 af
Outflow = 9.19 cfs @ 12.51 hrs, Volume= 1.166 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-YR Rainfall=4.50"

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Summary for Pond 1P: Detention Basin

Inflow Area = 3.950 ac, 31.65% Impervious, Inflow Depth > 1.75" for 10-YR event
 Inflow = 7.58 cfs @ 12.14 hrs, Volume= 0.575 af
 Outflow = 0.83 cfs @ 13.28 hrs, Volume= 0.563 af, Atten= 89%, Lag= 68.2 min
 Discarded = 0.83 cfs @ 13.28 hrs, Volume= 0.563 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 328.76' @ 13.28 hrs Surf.Area= 14,927 sf Storage= 10,803 cf

Plug-Flow detention time= 137.2 min calculated for 0.563 af (98% of inflow)
 Center-of-Mass det. time= 129.5 min (937.9 - 808.4)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	142,666 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	13,371	0	0
330.00	17,446	30,817	30,817
332.00	21,564	39,010	69,827
334.00	25,437	47,001	116,828
335.00	26,238	25,838	142,666

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	331.50'	24.0" Vert. Orifice/Grate C= 0.600
#3	Secondary	334.50'	15.0' long x 15.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60			
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63			

Discarded OutFlow Max=0.83 cfs @ 13.28 hrs HW=328.76' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.83 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑2=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: Subsurface Recharge

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 2.05" for 10-YR event
 Inflow = 0.82 cfs @ 12.09 hrs, Volume= 0.055 af
 Outflow = 0.13 cfs @ 11.80 hrs, Volume= 0.055 af, Atten= 84%, Lag= 0.0 min
 Discarded = 0.13 cfs @ 11.80 hrs, Volume= 0.055 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-YR Rainfall=4.50"

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Peak Elev= 328.85' @ 12.62 hrs Surf.Area= 2,310 sf Storage= 784 cf

Plug-Flow detention time= 47.2 min calculated for 0.054 af (99% of inflow)

Center-of-Mass det. time= 46.2 min (843.3 - 797.1)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	4,158 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,395 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	2,310	0	0
332.50	2,310	10,395	10,395

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	332.50'	30.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.13 cfs @ 11.80 hrs HW=328.05' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

G-353-POST*Type III 24-hr 25-YR Rainfall=5.30"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: Lawn/WoodsRunoff Area=10.610 ac 0.57% Impervious Runoff Depth>1.83"
Flow Length=1,640' Tc=33.9 min CN=67 Runoff=12.98 cfs 1.617 af**Subcatchment P2: Greystone Drive**Runoff Area=3.950 ac 31.65% Impervious Runoff Depth>2.33"
Flow Length=647' Tc=9.4 min CN=73 Runoff=10.17 cfs 0.767 af**Subcatchment P3: Millstone Drive**Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>2.68"
Flow Length=325' Tc=5.7 min CN=77 Runoff=1.07 cfs 0.071 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=12.98 cfs 1.617 af
Outflow=12.98 cfs 1.617 af**Pond 1P: Detention Basin**Peak Elev=329.10' Storage=15,992 cf Inflow=10.17 cfs 0.767 af
Discarded=0.87 cfs 0.618 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.87 cfs 0.618 af**Pond 2P: Subsurface Recharge**Peak Elev=329.25' Storage=1,156 cf Inflow=1.07 cfs 0.071 af
Discarded=0.13 cfs 0.071 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.071 af**Total Runoff Area = 14.880 ac Runoff Volume = 2.455 af Average Runoff Depth = 1.98"**
90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac

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Type III 24-hr 25-YR Rainfall=5.30"

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Summary for Subcatchment P1: Lawn/Woods

Runoff = 12.98 cfs @ 12.50 hrs, Volume= 1.617 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.680	77	Woods, Good, HSG D
1.990	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 0.170	80	Lawn, Good HSG D
* 3.050	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
10.610	67	Weighted Average
10.550		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
4.1	476	0.1470	1.92		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		Shallow Concentrated Flow, Segment 3
					Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	Trap/Vee/Rect Channel Flow, Segment 4
					Bot.W=5.00' D=2.00' Z= 3.0 '/' Top.W=17.00' n= 0.033
0.1	61	0.0160	7.52	13.29	Circular Channel (pipe), Segment 5
					Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
15.6	464	0.0050	0.49		Shallow Concentrated Flow, Segment 6
					Short Grass Pasture Kv= 7.0 fps
33.9	1,640	Total			

Summary for Subcatchment P2: Greystone Drive

Runoff = 10.17 cfs @ 12.14 hrs, Volume= 0.767 af, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (ac)	CN	Description
* 2.700	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.950	73	Weighted Average
2.700		Pervious Area
1.250		Impervious Area

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Type III 24-hr 25-YR Rainfall=5.30"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		Shallow Concentrated Flow, Segment 2 Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	Circular Channel (pipe), Segment 4 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

Summary for Subcatchment P3: Millstone Drive

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.071 af, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=5.30"

Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		Sheet Flow, Segment 2 Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	Circular Channel (pipe), Segment 3 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

Summary for Reach 1R: Pleasant St/Grist Mill RdInflow Area = 14.880 ac, 9.95% Impervious, Inflow Depth > 1.30" for 25-YR event
Inflow = 12.98 cfs @ 12.50 hrs, Volume= 1.617 af
Outflow = 12.98 cfs @ 12.50 hrs, Volume= 1.617 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-YR Rainfall=5.30"

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Summary for Pond 1P: Detention Basin

Inflow Area = 3.950 ac, 31.65% Impervious, Inflow Depth > 2.33" for 25-YR event
 Inflow = 10.17 cfs @ 12.14 hrs, Volume= 0.767 af
 Outflow = 0.87 cfs @ 13.84 hrs, Volume= 0.618 af, Atten= 91%, Lag= 102.3 min
 Discarded = 0.87 cfs @ 13.84 hrs, Volume= 0.618 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 329.10' @ 13.84 hrs Surf.Area= 15,619 sf Storage= 15,992 cf

Plug-Flow detention time= 183.1 min calculated for 0.618 af (80% of inflow)
 Center-of-Mass det. time= 130.7 min (932.6 - 801.9)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	142,666 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	13,371	0	0
330.00	17,446	30,817	30,817
332.00	21,564	39,010	69,827
334.00	25,437	47,001	116,828
335.00	26,238	25,838	142,666

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	331.50'	24.0" Vert. Orifice/Grate C= 0.600
#3	Secondary	334.50'	15.0' long x 15.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60			
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63			

Discarded OutFlow Max=0.87 cfs @ 13.84 hrs HW=329.10' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.87 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑ **2=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑ **3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Subsurface Recharge

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 2.68" for 25-YR event
 Inflow = 1.07 cfs @ 12.09 hrs, Volume= 0.071 af
 Outflow = 0.13 cfs @ 11.75 hrs, Volume= 0.071 af, Atten= 88%, Lag= 0.0 min
 Discarded = 0.13 cfs @ 11.75 hrs, Volume= 0.071 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-YR Rainfall=5.30"

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Peak Elev= 329.25' @ 12.82 hrs Surf.Area= 2,310 sf Storage= 1,156 cf

Plug-Flow detention time= 75.9 min calculated for 0.071 af (99% of inflow)

Center-of-Mass det. time= 74.9 min (865.9 - 791.1)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	4,158 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,395 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	2,310	0	0
332.50	2,310	10,395	10,395

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	332.50'	30.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.13 cfs @ 11.75 hrs HW=328.06' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

G-353-POST*Type III 24-hr 100-YR Rainfall=6.50"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: Lawn/WoodsRunoff Area=10.610 ac 0.57% Impervious Runoff Depth>2.66"
Flow Length=1,640' Tc=33.9 min CN=67 Runoff=19.11 cfs 2.356 af**Subcatchment P2: Greystone Drive**Runoff Area=3.950 ac 31.65% Impervious Runoff Depth>3.26"
Flow Length=647' Tc=9.4 min CN=73 Runoff=14.24 cfs 1.074 af**Subcatchment P3: Millstone Drive**Runoff Area=0.320 ac 53.13% Impervious Runoff Depth>3.67"
Flow Length=325' Tc=5.7 min CN=77 Runoff=1.45 cfs 0.098 af**Reach 1R: Pleasant St/Grist Mill Rd**Inflow=19.11 cfs 2.356 af
Outflow=19.11 cfs 2.356 af**Pond 1P: Detention Basin**Peak Elev=329.65' Storage=24,822 cf Inflow=14.24 cfs 1.074 af
Discarded=0.93 cfs 0.696 af Primary=0.00 cfs 0.000 af Secondary=0.00 cfs 0.000 af Outflow=0.93 cfs 0.696 af**Pond 2P: Subsurface Recharge**Peak Elev=329.93' Storage=1,785 cf Inflow=1.45 cfs 0.098 af
Discarded=0.13 cfs 0.098 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.098 af**Total Runoff Area = 14.880 ac Runoff Volume = 3.528 af Average Runoff Depth = 2.84"**
90.05% Pervious = 13.400 ac 9.95% Impervious = 1.480 ac

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Type III 24-hr 100-YR Rainfall=6.50"

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Summary for Subcatchment P1: Lawn/Woods

Runoff = 19.11 cfs @ 12.49 hrs, Volume= 2.356 af, Depth> 2.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.50"

Area (ac)	CN	Description
1.480	70	Woods, Good, HSG C
3.680	77	Woods, Good, HSG D
1.990	55	Woods, Good, HSG B
0.030	30	Woods, Good, HSG A
* 0.060	98	Ledge
* 0.170	80	Lawn, Good HSG D
* 3.050	61	Lawn, Good, HSG B
* 0.150	39	Lawn, Good, HSG A
10.610	67	Weighted Average
10.550		Pervious Area
0.060		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		Sheet Flow, Segment 1
					Woods: Light underbrush n= 0.400 P2= 3.00"
4.1	476	0.1470	1.92		Shallow Concentrated Flow, Segment 2
					Woodland Kv= 5.0 fps
0.2	39	0.2560	3.54		Shallow Concentrated Flow, Segment 3
					Short Grass Pasture Kv= 7.0 fps
1.2	550	0.0200	7.38	162.27	Trap/Vee/Rect Channel Flow, Segment 4
					Bot.W=5.00' D=2.00' Z= 3.0 '/' Top.W=17.00' n= 0.033
0.1	61	0.0160	7.52	13.29	Circular Channel (pipe), Segment 5
					Diam= 18.0" Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
15.6	464	0.0050	0.49		Shallow Concentrated Flow, Segment 6
					Short Grass Pasture Kv= 7.0 fps
33.9	1,640	Total			

Summary for Subcatchment P2: Greystone Drive

Runoff = 14.24 cfs @ 12.14 hrs, Volume= 1.074 af, Depth> 3.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.50"

Area (ac)	CN	Description
* 2.700	61	Lawn, Good, HSG B
* 1.250	98	Impervious
3.950	73	Weighted Average
2.700		Pervious Area
1.250		Impervious Area

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Type III 24-hr 100-YR Rainfall=6.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.0200	0.14		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.5	28	0.0200	0.99		Shallow Concentrated Flow, Segment 2 Short Grass Pasture Kv= 7.0 fps
1.0	169	0.0200	2.87		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
2.1	400	0.0050	3.21	2.52	Circular Channel (pipe), Segment 4 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
9.4	647	Total			

Summary for Subcatchment P3: Millstone Drive

Runoff = 1.45 cfs @ 12.09 hrs, Volume= 0.098 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=6.50"

Area (ac)	CN	Description
* 0.050	39	Lawn, Good, HSG A
* 0.100	61	Lawn, Good, HSG B
* 0.170	98	Impervious
0.320	77	Weighted Average
0.150		Pervious Area
0.170		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	31	0.0200	0.13		Sheet Flow, Segment 1 Grass: Short n= 0.150 P2= 3.00"
0.3	19	0.0250	1.04		Sheet Flow, Segment 2 Smooth surfaces n= 0.011 P2= 3.00"
1.1	221	0.0250	3.21		Shallow Concentrated Flow, Segment 3 Paved Kv= 20.3 fps
0.3	54	0.0050	3.21	2.52	Circular Channel (pipe), Segment 3 Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
5.7	325	Total			

Summary for Reach 1R: Pleasant St/Grist Mill Rd

Inflow Area = 14.880 ac, 9.95% Impervious, Inflow Depth > 1.90" for 100-YR event

Inflow = 19.11 cfs @ 12.49 hrs, Volume= 2.356 af

Outflow = 19.11 cfs @ 12.49 hrs, Volume= 2.356 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 100-YR Rainfall=6.50"

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Summary for Pond 1P: Detention Basin

Inflow Area = 3.950 ac, 31.65% Impervious, Inflow Depth > 3.26" for 100-YR event
 Inflow = 14.24 cfs @ 12.14 hrs, Volume= 1.074 af
 Outflow = 0.93 cfs @ 14.50 hrs, Volume= 0.696 af, Atten= 93%, Lag= 142.0 min
 Discarded = 0.93 cfs @ 14.50 hrs, Volume= 0.696 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 329.65' @ 14.50 hrs Surf.Area= 16,731 sf Storage= 24,822 cf

Plug-Flow detention time= 198.7 min calculated for 0.696 af (65% of inflow)
 Center-of-Mass det. time= 126.4 min (920.7 - 794.3)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	142,666 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	13,371	0	0
330.00	17,446	30,817	30,817
332.00	21,564	39,010	69,827
334.00	25,437	47,001	116,828
335.00	26,238	25,838	142,666

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	331.50'	24.0" Vert. Orifice/Grate C= 0.600
#3	Secondary	334.50'	15.0' long x 15.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60			
Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63			

Discarded OutFlow Max=0.93 cfs @ 14.50 hrs HW=329.65' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.93 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑2=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)
 ↑3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: Subsurface Recharge

Inflow Area = 0.320 ac, 53.13% Impervious, Inflow Depth > 3.67" for 100-YR event
 Inflow = 1.45 cfs @ 12.09 hrs, Volume= 0.098 af
 Outflow = 0.13 cfs @ 11.65 hrs, Volume= 0.098 af, Atten= 91%, Lag= 0.0 min
 Discarded = 0.13 cfs @ 11.65 hrs, Volume= 0.098 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 100-YR Rainfall=6.50"

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Peak Elev= 329.93' @ 13.10 hrs Surf.Area= 2,310 sf Storage= 1,785 cf

Plug-Flow detention time= 126.3 min calculated for 0.098 af (100% of inflow)

Center-of-Mass det. time= 125.5 min (909.3 - 783.8)

Volume	Invert	Avail.Storage	Storage Description
#1	328.00'	4,158 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,395 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
328.00	2,310	0	0
332.50	2,310	10,395	10,395

Device	Routing	Invert	Outlet Devices
#1	Discarded	328.00'	2.410 in/hr Exfiltration over Surface area
#2	Primary	332.50'	30.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

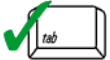
Discarded OutFlow Max=0.13 cfs @ 11.65 hrs HW=328.05' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.13 cfs)**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=328.00' (Free Discharge)↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)



Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☒ Static
 - ☐ Simple Dynamic
 - ☐ Dynamic Field¹
- ☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☐ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☐ Description and delineation of public safety features;
 - ☐ Estimated operation and maintenance budget; and
 - ☐ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

STORMWATER NARRATIVE

Design Methods and Objectives

The design of this residential subdivision has been prepared in accordance with Stormwater Management Standards as outlined in the Stormwater Management Handbook. In particular, the site has been designed to ensure:

1. No new stormwater conveyances will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. All pavement runoff from the development is routed through infiltration basins or a subsurface recharge system.
2. Stormwater management systems are designed so that the post-development peak discharge rate does not exceed pre-development peak discharge rates. Drainage calculations demonstrate that the peak rate of runoff is reduced in the post development condition through the use of an infiltration basin.
3. Loss of annual recharge to ground water is minimized through the use of an infiltration basin and subsurface recharge system. The basin and recharge, as designed will provide 51,050 cu.ft. of storage volume which is greater than the required recharge volume required for the combination of "A" and "B" soils, 1,863 cu.ft.
4. Stormwater management systems are designed to remove 80% TSS. The use of a deep sump catch basin, and infiltration basin provide a total of 85% TSS removal for runoff associated with Greystone Drive. The combination of a deep sump catch basin, water quality inlet and subsurface recharge provide a total of 89% TSS removal including 44% pretreatment for runoff associated with Millstone Drive.
5. The use of the site for a residential subdivision is not a risk for producing higher pollutant loads. Notwithstanding, the treatment of runoff from this portion of the site will ensure treatment of any potential pollutants.
6. This site is not within a Zone II or interim wellhead protection area.
7. This site is a new development and redevelopment and stormwater management guidelines are met.
8. For construction related activities, an operation and maintenance plan has been incorporated into the Stormwater Management Report to ensure that a protocol for runoff control is in place prior to any construction activities.
9. The operation and maintenance plan as provided provides a protocol to ensure that the stormwater management system will function as designed.
10. Prior to any construction related activities taking place, a certification regarding illicit discharges will be submitted.

STORMWATER MANAGEMENT CALCULATIONS

Total Impervious Area

Pavement: 42,751 sq.ft. /0.981 ac.
Buildings 19,500 sq.ft. /0.448 ac.
Total 62,251 sq.ft. / 1.429 ac.

Standard #3: Recharge to Groundwater

Recharge Required: $(0.60''/12 * 2,266 \text{ sq. ft. "A" impervious} = 113 \text{ cu.ft.}$
 $+ (0.35''/12) * 59,985 \text{ sq. ft. "B" impervious} = \underline{1,750 \text{ cu.ft.}}$
1,863 cu.ft.

Recharge Provided: 46,780 cu. ft. @ elev. 329.65 in infiltration basin (all runoff recharged)
4,270 cu. ft. @ elev. 329.93 in subsurface recharge (all runoff recharged)
51,050 cu. ft.

Drawdown within 72 hours

Time: $(24,836 \text{ cu.ft.} / (2.41''/\text{hr} * (1'/12'') * 13,371 \text{ sq.ft.})) = 9.2 \text{ hours in infiltration basin}$
 $(1,783 \text{ cu.ft.} / (2.41''/\text{hr} * (1'/12'') * 2,310 \text{ sq.ft.})) = 3.8 \text{ hours in subsurface recharge}$

Standard #4: Water Quality

Treatment Volume Required : $(0.5''/12) * 46,780 \text{ sq. ft.} = 1,949 \text{ cu. ft.}$
Treatment Volume Provided: 46,780 cu. ft. @ elev. 329.65 in infiltration basin (all runoff recharged)
4,270 cu. ft. @ elev. 329.93 in subsurface recharge (all runoff recharged)
51,050 cu. ft.

Water Quality Inlet Treatment Required: $0.149 \text{ ac. pavement} * 400 \text{ cu.ft./ac} = 60 \text{ cu.ft.}$
Water Quality Inlet Treatment Provided: $5 \text{ ft.} * 3 \text{ ft.} * 4 \text{ ft} = 60 \text{ cu.ft.}$

Forebay Sizing

Forebay Treatment Volume Required: $(0.1''/12) * 35,159 \text{ sq. ft.} = 293 \text{ cu. ft.}$
Forebay Treatment Volume Provided: 1,404 cu. ft. @ elev. 330.0 in forebay

INSTRUCTIONS:

- 1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
- 2. Select BMP from Drop Down Menu
- 3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: "Gristmill Village" Grafton - Greystone Drive

B	C	D	E	F
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Separate Form Needs to be Completed for Each Outlet or BMP Train

85%

Total TSS Removal =

Project: G-353

Prepared By:

Date: 3/13/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location:

"Gristmill Village" Grafton - Millstone Drive

B	C	D	E	F
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Oil Grit Separator	0.25	0.75	0.19	0.56
Subsurface Infiltration Structure	0.80	0.56	0.45	0.11
	0.00	0.11	0.00	0.11
	0.00	0.11	0.00	0.11

Separate Form Needs to be Completed for Each Outlet or BMP Train

Total TSS Removal =

89%

G-353

Project:

Prepared By:

Date: 3/13/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
 1. From MassDEP Stormwater Handbook Vol. 1

Project: **G-353**
Location: **Grafton, Massachusetts**

By: **DCT**
Chkd: **JMG**

Date: **3/13/2015**
Date: **3/13/2015**

Catchment Watershed Areas

Design Storm: **25** year

WA: **cb-1**

	Area (Ac)		C		AxC		
Paved:	0.09	x	0.9	=	0.081	Overland Flow Time:	5 min.
Dense grass:	0.07	x	0.3	=	0.021	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.16	x	0.64	=	0.10	Flow (Q=AxCxi):	0.5 cfs

WA: **cb-2**

	Area (Ac)		C		AxC		
Paved:	0.08	x	0.9		0.072	Overland Flow Time:	5 min.
Dense grass:	0.08	x	0.3		0.024	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.16	x	0.60	=	0.10	Flow (Q=AxCxi):	0.5 cfs

WA: **cb-3**

	Area (Ac)		C		AxC		
Paved:	0.13	x	0.9		0.117	Overland Flow Time:	5 min.
Dense grass:	0.12	x	0.3		0.036	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.25	x	0.61	=	0.15	Flow (Q=AxCxi):	0.8 cfs

WA: **cb-4**

	Area (Ac)		C		AxC		
Paved:	0.13	x	0.9		0.117	Overland Flow Time:	5 min.
Dense grass:	0.27	x	0.3		0.081	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.40	x	0.50	=	0.198	Flow (Q=AxCxi):	1.0 cfs

WA: **cb-5**

	Area (Ac)		C		AxC		
Paved:	0.24	x	0.9		0.216	Overland Flow Time:	5 min.
Dense grass:	0.24	x	0.3		0.072	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.48	x	0.60	=	0.29	Flow (Q=AxCxi):	1.5 cfs

Project: **G-353**
Location: **Grafton, Massachusetts**

By: **DCT**
Chkd: **JMG**

Date: **3/13/2015**
Date: **3/13/2015**

Catchment Watershed Areas

Design Storm: **25** year

WA: **cb-6**

	Area (Ac)		C		AxC		
Paved:	0.24	x	0.9	=	0.216	Overland Flow Time:	5 min.
Dense grass:	0.31	x	0.3	=	0.093	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	0.55	x	0.56	=	0.31	Flow (Q=AxCxi):	1.6 cfs

WA: **cb-7**

	Area (Ac)		C		AxC		
Paved:	0.52	x	0.9		0.468	Overland Flow Time:	5 min.
Dense grass:	1.05	x	0.3		0.315	Intensity:	5.3 in/hr
<hr/>							
TOTAL:	1.57	x	0.50	=	0.78	Flow (Q=AxCxi):	4.1 cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

WA:

	Area (Ac)		C		AxC		
Paved:		x				Overland Flow Time:	min.
Dense grass:		x				Intensity:	in/hr
<hr/>							
TOTAL:		x		=		Flow (Q=AxCxi):	cfs

Project: **G-353**
 Location: **Grafton, Massachusetts**

By: **DCT**
 Chkd: **JMG**

Date: **10/28/2014**
 Date: **10/28/2014**

Catchment Watershed Areas

Design Storm: **50** year

WA: **culvert**

	Area (Ac)	C	AxC	
Paved:	x		=	Overland Flow Time: 5 min.
Dense grass:	4.79	0.3	= 1.437	Intensity: 5.9 in/hr
<hr/>				
TOTAL:	4.79	0.30	= 1.44	Flow (Q=AxCxi): 8.5 cfs

WA:

	Area (Ac)	C	AxC	
Paved:	x			Overland Flow Time: min.
Dense grass:	x			Intensity: in/hr
<hr/>				
TOTAL:	x	=		Flow (Q=AxCxi): cfs

WA:

	Area (Ac)	C	AxC	
Paved:	x			Overland Flow Time: min.
Dense grass:	x			Intensity: in/hr
<hr/>				
TOTAL:	x	=		Flow (Q=AxCxi): cfs

WA:

	Area (Ac)	C	AxC	
Paved:	x			Overland Flow Time: min.
Dense grass:	x			Intensity: in/hr
<hr/>				
TOTAL:	x	=		Flow (Q=AxCxi): cfs

WA:

	Area (Ac)	C	AxC	
Paved:	x			Overland Flow Time: min.
Dense grass:	x			Intensity: in/hr
<hr/>				
TOTAL:	x	=		Flow (Q=AxCxi): cfs

DESIGN STORM: 25 yr.

PROJECT _____
LOCATION _____
JOB NO. _____
FILE NO. _____

CALC BY _____
DATE _____
CHKD BY _____
DATE _____

OPERATION AND MAINTENANCE PLAN

“Gristmill Village”

Grafton

March 13, 2015

The following are operation and maintenance instructions for both construction and post-development stormwater controls. The goal of these plans is to ensure that the stormwater system, as designed, will function properly during construction and for the future of the site. The developer of the parcel is Casa Builders & Developers Corp. Steve Venincasa is the contact person for work related to this project, and can be contacted at the following number: (508) 560-9440.

Construction Operation and Maintenance Plan:

1. All erosion and sediment control devices installed prior to construction shall be inspected on a daily basis. Any deficiencies in the siltation fence shall be corrected immediately. Any accumulated silt shall be removed manually from the silt fence. Silt barrier should be inspected daily to ensure that there is no accumulation of sediments.
2. The most important aspects of controlling erosion and sedimentation are limiting the extent of disturbance and stabilizing surfaces as soon as possible. Of secondary importance in erosion control is limiting the size and length of the tributary drainage area within the work site and drainage structures. These fundamental principles shall be the key factor in the control of erosion on the site.
3. All disturbed surfaces shall be stabilized a minimum of 14 days after construction in any portion of the site has ceased or is temporarily halted unless additional construction is intended to be initiated within 21 days.
4. Hydroseeding and hay mulching shall be performed immediately after construction to minimize erosion damage. Newly seeded slopes shall be inspected every two weeks for the first few months to ensure that revegetation has occurred. Repairs and reseedling shall be performed immediately as the need arises.
5. The catch basin grate inlets are to be covered with plywood prior to the installation of pavement. This will prevent excess silt from accumulating in sumps and pipes. After pavement has been installed, a block and gravel inlet protection device shall be constructed surrounding the catch basin rims. This will keep silt out of the basins until the remainder of the site has been stabilized. The stone from the inlet protection shall be maintained frequently to ensure the highest degree of filtration.
6. As noted on the site plans, the basin shall be used to capture runoff from up-gradient areas during construction. However, the elevations of the basin shall be left one foot above proposed finish grades until all up-gradient areas are stabilized. At this time all accumulated sediments shall be removed from the basin area and the basin shall be excavated to the proposed finish grade.

7. At no time shall silt laden water be allowed to enter sensitive areas (wetlands, and off-site areas). Any runoff from disturbed surfaces shall be directed through settling basins and erosion control barriers prior to entering any sensitive areas.
8. At the completion of construction all areas are to be loamed and seeded to ensure that the site is stabilized.

Post Development Operation and Maintenance Plan:

1. Seeding and repairs shall be performed as required. Sediment and debris shall be removed at least once a year, typically in early spring prior to the commencement of the growing season.
2. The catch basins and water quality inlet on the site shall be inspected annually. Units shall be cleaned when accumulated sediments reach a depth of 6 inches. Accumulated sediment must be disposed of in accordance with applicable local state, and federal guidelines and regulations. The contractor will be responsible for the maintenance of the unit until such time as the site work is complete. The maintenance will then be the responsibility of the Town of Grafton
3. A contract with a licensed hauler shall be in place for maintenance of drainage structures to ensure the long term performance of the drainage system.
4. The infiltration basin shall be inspected after every major storm for the first 3 months and on a semi-annual basis after to ensure that it is functioning properly and that the vegetation is adequately established. It shall be inspected for the following: slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sediment. Regular maintenance shall include: regular mowing (not shorter than 4").
5. The drainage swales shall be inspected and mowed at least twice annually. Weeds and other vegetation shall be removed as necessary. The outlet shall be inspected twice annually and kept clear of debris. Sediment and debris shall be removed once a year. Grass height shall be between 3 and 6 inches.
6. The subsurface infiltration system shall be inspected after every major storm for the first 3 months to ensure proper function. It shall be inspected once per year after that. Water levels should be inspected and recorded for several days after a major storm event to check infiltration capacity.
7. The contractor will be responsible for the maintenance of all drainage structures and until such time as the site work is complete. The maintenance will then be the responsibility of Town of Grafton.

LONG TERM POLLUTION PREVENTION PLAN

“Gristmill Village”

Grafton

March 13, 2015

This plan was developed in compliance with the Massachusetts Department of Environmental Protection Stormwater Requirements

Good Housekeeping

The proposed site is designed to maintain high quality water treatment for all runoff. A general maintenance plan has been prepared and will be followed in a strict and complete manner as required.

Spill Prevention Plan

No hazardous materials will be stored on site. However the following spill prevention plan will be incorporated into the Long Term Pollution Prevention Plan

1. Manufacturers recommended methods for spill cleanup will be clearly posted. Site personnel will be made aware of the procedures and location of the information and cleanup supplies.
2. Materials and equipment necessary for spill cleanup will be kept in the materials storage area. Equipment and materials will include, but is not limited to, brooms dust pans, mops, rags, gloves, sand and trash containers specifically for this purpose.
3. All spills will be cleaned up immediately after discovery.
4. The spill area will be kept will ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
5. Spills of toxic or hazardous material will be reported, regardless of size, to the Massachusetts Department of Environmental Protection (888) 304-1133
6. Should a spill occur, the spill prevention plan will be adjusted to include measures to prevent another spill and to cleanup the spill should another occur. A description of the spill along with the causes and cleanup measures will be included in the updated pollution prevention plan.
7. The construction superintendant responsible for daily operation on the site will be the spill prevention and cleanup coordinator. The superintendant will designate at least three site personnel to receive spill prevention cleanup training. The names of the responsible spill personnel will be posted in the material storage area.

Stormwater BMP Maintenance

A full BMP maintenance plan has been prepared (see Operation & Maintenance Plan) in order to ensure that the stormwater management system will function properly and as designed.

Landscape and Lawn Maintenance

Routine mowing and associated maintenance of all landscape features will occur weekly or as needed to prevent excessive growth of vegetation on site.

Solid Waste Maintenance

Solid waste is handled on site and will comply with all local, state and federal requirements.

Roadway Maintenance

roadways will be swept once a year to remove sand and other materials deposited on paved surfaces.

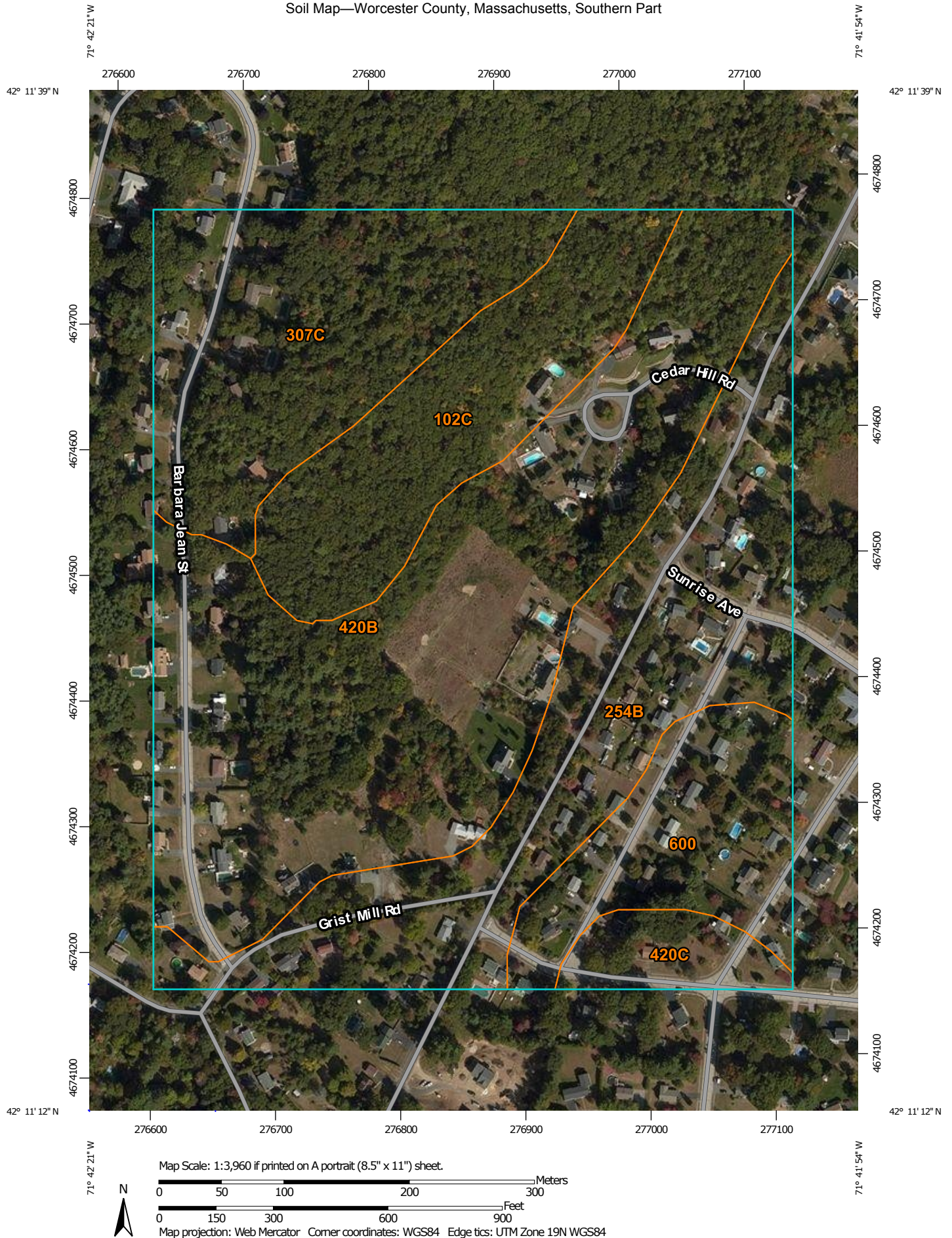
Training of Staff

All personnel on site will be briefed on all requirements for implementing the Long Term Pollution Prevention Plan.

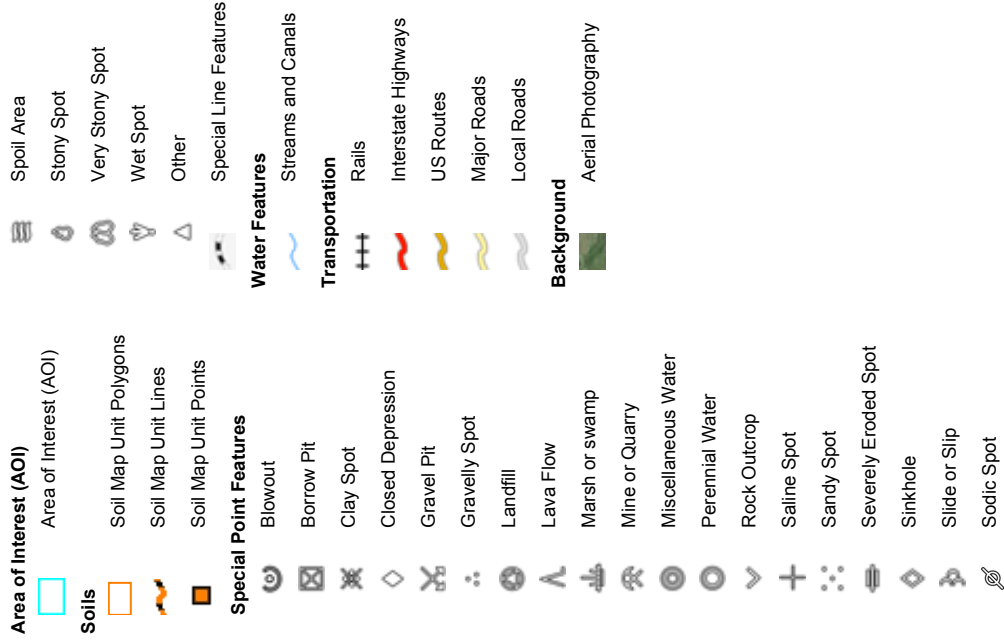
Emergency Contact for Long Term Pollution Prevention Plan

J.M. Grenier Associates, Inc.
787 Hartford Turnpike
Shrewsbury, MA 01545
(508) 845-2500

Soil Map—Worcester County, Massachusetts, Southern Part



MAP LEGEND



MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Southern Part

Survey Area Data: Version 7, Sep 22, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Worcester County, Massachusetts, Southern Part (MA615)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
102C	Chatfield-Hollis-Rock outcrop complex, 3 to 15 percent slopes	9.9	12.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	17.5	22.2%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	13.3	17.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	28.5	36.3%
420C	Canton fine sandy loam, 8 to 15 percent slopes	2.3	3.0%
600	Pits, gravel	7.0	8.9%
Totals for Area of Interest		78.6	100.0%

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 1 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	A	SL			BOULDERS. GRAVELLY COBBLES VERIGATED MOTTLING@60" GRAVELLY BELOW MOTTLE
8-20	B	SL			
20-104	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >104"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 2 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10	A	SL			GRAVELLY, COBBLES STONY
10-24	B	SL			
24-90	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >90"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 3 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10	A	SL			GRAVELLY, COBBLES STONY NO MOTTLES
10-26	B	SL			
24-90	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >90"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 4 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	A	SL			GRAVELLY, COBBLES STONY VERIGATED MOTTLES @44"
8-32	B	SL			
32-104	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >104"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 5 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10	A	SL			GRAVELLY, COBBLES STONY NO MOTTLING SOME VERIGATED MOTTLING @40" NO SIGNS OF GROUNDWATER
10-26	B	SL			
26-98	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >98"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE

FORM 11 – SOIL EVALUATOR FORM

Location Address or Lot No. "GRISTMILL VILLAGE", GRAFTON

On-Site Review

Deep Hole Number 6 Date: 7/24/14 Time: 9:00 A.M. Weather: 80, SUNNY

Location (identify on site plan): _____

Land Use- VACANT Slope (%) 2-5 Surface Stones NONE

Vegetation- SCRUB/BRUSH

Landform _____

Position on Landscape (sketch on back) _____

Distances from:

Open Water Body >300 feet

Drainage way- >100 feet

Possible Wet Area >100 feet

Property Line- >30 feet

Drinking Water Well >100 feet

Other -

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-6	A	SL			GRAVELLY, COBBLES STONY NO WEEP, WATER, REFUSAL
6-20	B	SL			
20-120	C	LS			

*MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic) TILL Depth to Bedrock: >120"

Depth to Ground Water: Standing Water in the Hole N/A Weeping from Pit Face: N/A

Estimated Seasonal High Ground Water: NONE